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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte ZILI LI,
JON SCHINDLER, ROBERT AKINS, and
GEORGE VALLIATH

Appeal 2009-004581
Application 09/667,641
Technology Center 2800

Decided: 29 September 2009

Before CHUNG K. PAK, TERRY J. OWENS, and MARK NAGUMO, *Administrative Patent Judges*.

NAGUMO, *Administrative Patent Judge*.

DECISION ON APPEAL

A. Introduction[1]

Zili Li, Jon Schindler, Robert Akins, and George Valliath ("Li") timely appeal under 35 U.S.C. § 134(a) from the final rejection[2] of claims 1-3.[3] We have jurisdiction under 35 U.S.C. § 6. We REVERSE.

The subject matter on appeal relates to an electrically tunable color cholesteric liquid crystal device. According to the 641 Specification, color tunability is achieved by providing a cholesteric liquid crystal cell in a state that reflects blue light in the direction perpendicular to the face of the cell; then applying an electric field to the cholesteric liquid crystal, preferably parallel to the face of the cell. The applied electric field is said to alter the helical pitch of the cholesteric liquid crystal in the cell, thus shifting the wavelength of reflected light to the red. The device is said to fulfill a long-felt need for a cholesteric liquid crystal device that uses a single layer of liquid crystal material to provide a multicolor display. (Spec. 2.) The device is said to be readily manufactured and relatively inexpensive.

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[1] Application 09/667,641, *Liquid Crystal Device Having Variable Reflected Wavelength*, filed 23 September 2000. The specification is referred to as the "641 Specification," and is cited as "Spec." The real party in interest is listed as Motorola, Inc. (Appeal Brief under 37 C.F.R. § 41.37, filed 13 October 2006 ("Br."), 3.)

[2] Office action mailed 21 March 2006 ("Final Rejection"; cited as "FR").

[3] Claims 4-17, the only other pending claims, have been withdrawn from consideration. (FR 1.)

Representative Claim 1 is reproduced from the Claims Appendix to the Principal Brief on Appeal, annotated with labels to Figure 1 of the 641 Specification, which is reproduced *infra* at 6:

1. A liquid crystal device comprising

    a transparent front plate [6];

    a back plate [8] spaced apart from the transparent front plate;

    a cholesteric liquid crystal material [5] between said transparent front plate and said back plate,

        said cholesteric liquid crystal material having a reflective state wherein said cholesteric liquid crystal material reflects light through said front plate, said light characterized by a first wavelength in the absence of an applied electric field; and

    means for applying an electric field [24, 26, 28, 30], parallel to the back plate, to said cholesteric liquid crystal material in the reflective state to cause said cholesteric liquid crystal material to reflect light characterized by a second wavelength different than said first wavelength.

(Claims App., Br. 8; indentation and bracketed labels corresponding to Fig. 1 added for illustration only.)

The Examiner has maintained the following ground of rejection:[4]

> Claims 1-3 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Buzak[5] and Kondo.[6]

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[4] Examiner's Answer mailed 16 January 2007. ("Ans.").

[5] Thomas S. Buzak, *Switchable Color Filter with Enhanced Transmissivity*, U.S. Patent 4,726,663 (1988).

[6] Katsumi Kondo et al., *Liquid Crystal Display Device*, U.S. Patent 5,598,285 (1997).

Li contends the Examiner erred by failing to demonstrate a suggestion or motivation to modify the references to obtain the claimed invention. In particular, Li argues that Kondo expressly discloses the use of an in-plane field to switch nematic liquid crystals, and there is no reason to apply that teaching to the chiral liquid crystals required by Buzak. (Br. 5.)

The Examiner finds that Buzak describes a liquid crystal device, shown in Figure 3, that meets all the limitations recited in claim 1 but for the means for applying an electric field parallel to the back plate of the device. (FR 2.) The Examiner finds further that Kondo shows that such in-plane switching is commonly used in liquid crystal display devices to provide advantages such as wide angle viewing. (*Id.* at 2-3.) The Examiner finds further that Kondo describes the use of twisted nematic liquid crystals, which are, according to the Examiner, nematic liquid crystals with a chiral dopant (Ans. 6, citing four US patents). The Examiner concludes that it would have been obvious to provide the means for applying an electric field parallel to the back plate in the device taught by Buzak to obtain wider viewing angles. (FR 2-3.)

The issue dispositive of this appeal is: has the Examiner shown that a person having ordinary skill in the art would have had an adequate reason to apply the teachings of Kondo regarding improving the viewing angle of liquid crystal display devices to the liquid crystal color-reflective filters used by Buzak?

B. Findings of Fact

Findings of fact throughout this Opinion are supported by a preponderance of the evidence of record.

The 641 Specification

1. Nematic liquid crystals are formed by rod-like molecules that melt to form a liquid phase in which the rods are, on average, locally oriented in the same direction, but in which there is no long range order in any other direction.

2. According to the 641 Specification, cholesteric liquid crystal materials are preferably composed of a nematic host with chiral dopants. (Spec. 1, ll. 26-27.)

3. The 641 Specification teaches that the chiral dopant causes the molecules to form a helical arrangement, with the long axis of each molecule perpendicular to the helical axis, and the helical axis perpendicular to the front plate. (Spec. 1, ll. 29-31.)

4. According to the 641 Specification, the helical state is reflective, and the pitch of the helix is directed related to the wavelength of the reflected light. (Spec. 1, ll. 31-32.)

5. Adding more dopant is said to shift the reflected wavelength to shorter wavelengths, i.e., to the blue. (Spec. 2, ll. 9-15.)

6. Figure 1, which shows a drawing of the invented liquid crystal cell 2, is reproduced below:

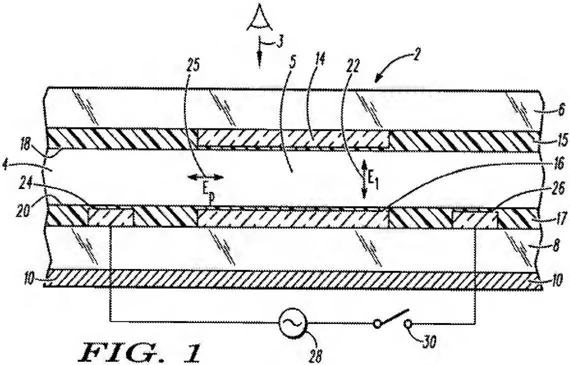


FIG. 1

{Figure 1 is said to show a single pixel of a liquid crystal display}

7. The liquid crystal material 5 is confined between a transparent front plate 6 and back plate 8, which is provided with outer opaque layer 10. (Spec. 5, ll. 5-13.)

8. Thus, when liquid crystal material 5 is reflective, the display is bright (and colored), and when it is transparent, the display is dark, due to opaque layer 10.

9. The 641 Specification teaches that plates 6 and 8, including any electrodes disposed on them, are covered with transparent polymeric coatings 15 and 17, which have rubbed inner surfaces "for orienting the cholesteric liquid crystal molecules in the reflective state in a planar

alignment effective to reflect light through the front plate, as is known in the art." (Spec. 5, l. 31, to 6, l. 3.)

10. Thus, the (rod-like) molecules are oriented generally parallel to the plane of the front plate in the rubbed direction at the polymer surface, but the direction of orientation shifts, tracing out a helix having a certain pitch down through the cell to the back plate, where they are oriented generally parallel to the rubbed direction at that polymer surface.

11. Electrodes 24 and 26, together with power supply 28 and switch 30, are provided on back plate 8 to apply an electric field E_p in direction 25, generally parallel to the surface of plate 8. (Spec. 6, l. 30, to 7, l. 5.)

12. According to the 641 Specification, it is thought that the interaction of E_p with the cholesteric liquid crystal molecules changes the pitch of the helical arrangement and thus changes the wavelength of light reflected by the device. (Spec. 8, ll. 3-25.)

13. As shown in Figure 2 (not reproduced here), in an embodiment, the reflected light was shifted from blue (490 nm) to green (550 nm) to red (650 nm) by applying an AC square wave having an amplitude ranging from about 100 volts to about 300 volts across back plate electrodes [24 and 26] each 10 microns wide, separated by about 50 microns, in a cholesteric liquid crystal material about 5 microns thick. (Spec. 9, ll. 13-31.)

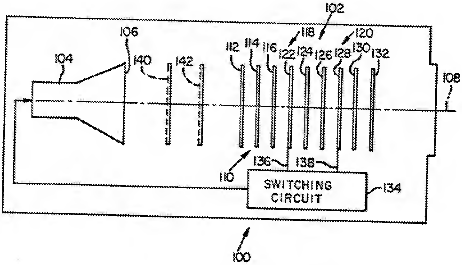
14. Although not required by appealed claims 1-3, Figure 1 shows transparent electrodes 14 and 16 disposed on interior surfaces 18 and 20 of front and back plates 6 and 8, respectively. (Spec. 5, ll. 24-31.)

15. The application of a voltage across electrodes 14 and 16 creates an electric field E_t along direction 22, parallel to the helical axis (Spec. 5, ll. 21-26), causes molecules having a "positive dielectric anisotropy" (*id.* at ll. 13-16) to align parallel to the electric field, thereby disrupting the helix, so the liquid crystal no longer reflects light (*id.* at 1, l. 33, to 2, l. 4).

Buzak

16. Buzak describes switchable color filters with enhanced transmissivity that transmit visible light having spectral components that are included within at least two color bands. (Buzak, col. 1, ll. 31-33; ll. 42-47.)

17. An embodiment of color filter 102, adapted for a full color projection system 100, is shown in Figure 3, which is reproduced below:



{Figure 3 is said to show a color projection system}

18. Color projection system 100 comprises switchable color filter 102, which polarizes the light and selectively outputs red, green, or blue light. (Buzak, col. 5, ll. 19-21, 30-35.)

19. Switchable color filter 102 in turn comprises polarizing assembly 110, and first and second light modulating sections 118 and 120. (Buzak, col. 5, ll. 42-43, 50-53.)

20. Polarizing assembly 110 comprises three plane parallel right-hand twist chiral liquid crystal cells 112, 114, and 116, which are tuned to selectively reflect right-circularly polarized green, red, and blue light, respectively. (Buzak, col. 5, ll. 42-49.)

21. First light modulating section 118 comprises variable optical retarder 122 and selective color reflecting chiral liquid crystal cells 124 and 126. (Buzak, col. 5, ll. 54-57.)

22. Similarly, second light modulating section 120 comprises variable optical retarder 128 and selective color reflecting chiral liquid crystal cells 130 and 132. (Buzak, col. 5, ll. 63-67.)

23. In Buzak's words, "[c]hiral liquid crystal cells are known in the art and function in a manner similar to that described for a cholesteric layer discussed in the article 'Twisted nematic display with cholesteric reflector,' *J. Phys. D: Appl. Phys.*, Vol. 8, 1141-48 (1975) by Scheffer." (Buzak, col. 3, ll. 30-35.)

24. Notably, Buzak describes and shows an electrical switching circuit to be connected only to variable optical retarders 122 and 128.

25. Buzak does not describe chiral liquid crystal cells 112, 114, 116, 124, 126, 130, and 132 as active devices.

26. Rather, the chiral liquid crystal cells described incidentally by Buzak appear to be passive devices, like ordinary colored glass filters, rather than active devices like variable optical retarders or liquid crystal display cells.

Kondo

27. According to Kondo, standard liquid crystal display devices provide a pair of transparent electrodes and transparent orienting layers on the facing surfaces of two substrates, with a liquid crystal layer between them. (Kondo, col. 1, ll. 26-37.)

28. Such devices are said to provide significant variation in brightness at different viewing angles. (Kondo, col. 2, ll. 38-42.)

29. Kondo describes liquid crystal display devices comprising a liquid crystal layer between a pair of polarizing plates, without transparent electrodes (Kondo, col. 2, ll. 62-67), that are said to have improved visual angle characteristics (*id.* at col. 9, ll. 52-53).

30. According to Kondo, the electrical field in the improved liquid crystal display devices is generated in the liquid crystal layer with components parallel to the plane of the liquid crystal layer (Kondo, col. 3, ll. 3-7) by electrodes that are preferably all on the same side of the liquid crystal layer (*id.* at ll. 24-25.)

31. In Kondo's words, "[i]n a conventional TN type of liquid crystal display device in which the long axes of the liquid crystal molecules are perpendicular to the substrate interface, a birefringence phase difference of zero is obtained only in a visual direction perpendicular to the front or [sic: of] the substrate interface." (Kondo, col. 9, l. 66 to col. 10, l. 3.)

32. In other words, only when looking straight on at a conventional twisted nematic liquid crystal cell is the full effect of perpendicular alignment (i.e., a dark cell, between crossed polarizers) seen.

33. In contrast, according to Kondo:

> [i]n the display mode [of the disclosed cells], the long axes of the liquid crystal molecules are almost parallel to the substrate at all times and do not become perpendicular to the substrate, so that there is only a small change in brightness when the visual angle is changed. . . . Thus, *the display mode of the present invention differs fundamentally from that of the conventional device*.

(Kondo, col. 9, ll. 54-65; emphasis added.)

34. In the examples, Kondo describes liquid crystal display devices based on nematic liquid crystal materials having positive dielectric anisotropy (e.g., Embodiment 1 at Kondo, col. 13) as well as negative dielectric anisotropy (e.g. Embodiments 20-26 at Kondo, cols. 22-23).

35. Kondo remarks that in embodiments 24 to 26,

> only the thickness of the liquid crystal composition layer d is changed. However, as well as the other type of the liquid crystal display (such as the 90-degree twisted nematic type), the same result for the optimum brightness can be obtained even if the refractive index anisotropy Δn is changed.

(Kondo, col. 23, ll. 20-26.)

C. Discussion

As the Appellant, Li bears the procedural burden of showing harmful error in the Examiner's rejections. *See, e.g., In re Kahn*, 441 F.3d 977, 985-86 (Fed. Cir. 2006) ("On appeal to the Board, an applicant can

overcome a rejection [under § 103] by showing insufficient evidence of *prima facie* obviousness") (citation and internal quote omitted).

As Li correctly points out, and as the Examiner does not dispute, Buzak describes color filters that comprise chiral liquid crystal layers that are said to function in a manner similar to that described by a cholesteric layer. (Br. 5, ll. 9-14.) As Li further points out, Kondo describes only nematic liquid crystals.

The Examiner responds that "Kondo discloses the use of twisted nematic type (TN) liquid crystal in the display device (see at least col. 23, 2nd and 3rd paragraph)." By definition, "twisted nematic type liquid crystal comprises a chiral dopant added to nematic liquid crystal." (Ans. 6, citing three US patents.)

This response is inaccurate. Kondo, at col. 23, does not describe display devices that comprise "twisted nematic liquid crystals." Rather, Kondo compares the performance of the Kondo liquid crystal devices with standard twisted nematic liquid crystal display devices. The Examiner has not directed our attention to other specific disclosures of Kondo devices that allegedly use "twisted nematic liquid crystals." Thus, on the present record, Kondo does not provide any teachings that, when combined with Buzak, could establish a prima facie case of obviousness of the subject matter covered by claims 1-3. Moreover, the term "twisted nematic" is generally applied to a class of liquid crystal devices (*see, e.g.,* Kondo at col. 9, l. 54, to col. 20, l. 7, distinguishing its liquid crystal devices from a "conventional TN type of liquid crystal display device" as well as the passages cited by the Examiner in Masazumi and in Yamakawa), rather than to a class of liquid

crystal materials.[7] Finally, the Examiner has failed to show that any addition of electrodes to the chiral liquid crystal cells used by Buzak would have been obvious because there is no credible evidence of record that those color reflective chiral liquid crystal cells have or need electrodes to selectively reflect and transmit light having a specified polarization and range of wavelength (color).

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[7] The Examiner's citation of patents for the first time in the Answer, in response to Appellants' Brief, illustrates why the Federal Circuit has endorsed the use of technical dictionaries at any time during consideration of a patent, and, by extension, during consideration of a patent application:

> Because dictionaries, and especially technical dictionaries, endeavor to collect the accepted meanings of terms used in various fields of science and technology, those resources have been properly recognized as among the many tools that can assist the court in determining the meaning of particular terminology to those of skill in the art of the invention. . . . Such evidence, we have held, may be considered if the court deems it helpful in determining 'the true meaning of language used in the patent claims.'

Phillips v. AWH Corp., 415 F.3d 1303, 1318 (Fed. Cir. 2005; citations omitted).

In contrast, individual technical publications, and even more so patents, may use idiosyncratic definitions for terms, since they are not necessarily concerned with the generally accepted meanings. For this reason, as well as to promote the thorough exploration of the meaning of claim terms and the technology, such definitional issues should be fully developed *prior* to appeal.

D. Order

We REVERSE the rejection of claims 1-3 under 35 U.S.C. § 103(a) in view of the combined teachings of Buzak and Kondo.

REVERSED

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